REMARKS

Claims 1-25 are in the application.

FORMAL REJECTIONS

Fig. 13 is objected to as failing to include the legend "Prior Art". Applicant respectfully submits, however, that to the extent that this Figure shows segment lengths optimized according to the present invention, it is not prior art. Since this Figure is intended to depict graphically the limitations of claim 5, it is respectfully submitted that this requirement is in error. Reconsideration of this requirement is respectfully solicited.

Claims 1-25 are rejected under 35 U.C.S. § 112, first paragraph, as failing to be supported by an enabling specification.

Claims 1-25 are rejected for failing to provide any substantive detail, other than mere reference, to a model, characteristic values, transfer functions, algorithms, distributions, and means for optimization. The Examiner also states that the claim element "air-spaced transmission line" is not adequately disclosed.

Applicants initially note that the study of transmission lines is old, as are their mathematical analysis and modeling, including transfer functions.

MPEP 608.01(p) addresses the issues of completeness of the specification, and expressly permits incorporation of essential and non-essential information through incorporation by reference. While a broad incorporation by reference may be insufficient to demonstrate that the applicant possessed the invention, where the relevance of the reference is discussed in the specification, and that relevance relates to the issue of possession, the Examiner is not free to ignore the incorporated references.

In the present case, US 5,455,548 is "expressly incorporated herein". The referencing section of the specification makes it clear that this reference is principally distinguished by the use of a "progressive distribution" of line lengths, as opposed to the optimized distribution according to the present invention. A review of Fig. 2 will reveal that, in accordance with PTO policies, the space between the center conductor and outer shell is transparent, indicating air or vacuum. Since no vacuum seals are disclosed, one would interpret this as air. Thus, this reference supports the "air-spaced transmission line" element of the claims. Likewise, US 4,831,346 ("expressly incorporated herein by reference") discloses "air dielectric coaxial cables", which represent the same technical construction as the present "air-spaced transmission

line", and would have been recognized by one of ordinary skill in the art at the time of the invention to relate to the same concept.

Applicant takes note of the discussion of the incorporation by reference doctrine discussed by the Examiner. Applicant, however, disagrees with the conclusions drawn by the Examiner. Clearly, the fact that basically the <u>entire</u> incorporated reference relates to a solution to the same basic problem as the present invention, that of selecting segment length for (air dielectric) coaxial transmission lines to minimize VSWR, and indeed presents this in the patent application as the problem to be solved, clearly indicates that the applicant was indeed in possession of this aspect of the invention, and further that the specification is enabling for such an air dielectric coaxial cable (air spaced transmission line).

US 5,436,846 relates to a point discontinuity model for predicting the performance of a microwave system. This aspect of the reference is particularly discussed in the specification of the present application. This patent particularly discloses the mathematics involved in a performance analysis of a microwave transmission system. There are likewise commercial products which will analyze a transmission system, once its characteristics are described.

Since these transfer functions and performance analysis of transmission lines are well known in the art, it is unclear why the Examiner cites the highlighted sections of MPEP 2163.02 against applicant. The level of skill in the art of transmission line analysis and optimization includes, as a minimum, a knowledge of what a transmission line is (including the requirement for a dielectric) and certainly based on a review of the present disclosure, that the various discontinuities result in performance degradation. The person of ordinary skill does not require a definition of terms and phrases commonly used in the art. Such terms and phrases include VSWR, transfer function, and the like. While the person of ordinary skill in the art likely cannot calculate VSWR of a complex system in his head, he does not need to. Automated systems are commercially available, as indicated in the specification, and such a person would know where and how to obtain such a system, if required. Thus, the Examiner's rejection of the claims as failing to be supported by an enabling specification is not well taken.

The prior art also clearly teaches one of ordinary skill in the art the relevant parameters of an electrical performance model of a transmission line, and further which aspects of the electrical performance are most pertinent to an analysis.

What is lacking from the prior art is a teaching of the present method of optimization. This method is, indeed, disclosed in the specification in such manner as to enable one of ordinary skill in the art to make, use and sell the invention.

For example, the specification states as follows:

> Computer Linear circuit simulation or network analysis is the analytical solution for the response of electrical components to an applied stimulus. Transformations of circuit parameters according to Laplace, Thevenin and Norton, allow the generation of transfer functions to create a system of equations. Unknowns are derived by Matrix methods to solve the equations then manipulated to produce s-parameters that completely describe the response of the network ports.
>
> The available engineering analysis programs relieve the Engineer from the solution and presentation or graphics phase, and allows for full concentration on the problem. A library of components, that includes assemblies of components like transmission line sections, is provided to characterize and assemble into a model. When a component is not in the library, s-parameters of an actual physical component can be incorporated into the model as a ported Black Box. Parameters of an elbow, filter or antenna can be added to analyze a complete system. A full understanding of the assembly is required to interpret the parameters and results.
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> The method according to the present invention, therefore makes no incremental spacing presumption. An optimized set of line lengths is calculated based on a model of the system, with an optimization parameter addressing the electrical characteristics of the resulting system. This simulation does not depend on any particular increment of line lengths, and indeed the starting condition of the model simulation may be equal line

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> The method according to the present invention, therefore makes no incremental spacing presumption. An optimized set of line lengths is calculated based on a model of the system, with an optimization parameter addressing the electrical characteristics of the resulting system. This simulation does not depend on any particular increment of line lengths, and indeed the starting condition of the model simulation may be equal line lengths. The vector calculus employed by the model references stepped impedance, attenuation, dielectric constant, and capacitive discontinuity at each segmental connector, as well as the desired bandwidth, individual line length, and total run length.
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> For example, it may be desired to build a transmission line with 20 sections, have minimum VSWR contribution from flange connections and operate over the UHF TV band. From the prior art, it is known that lengths spread over a 6 inch range will reduce flange discontinuities. Accordingly initial lengths will range from 240 to 234 inches. Connections are made by combining nodes, consecutively assigned to each component. Input and Output Ports are connected by node numbers assigned to the first and last transmission line model components. Each transmission line segment is similar in performance, other than variations resulting from differences in length. The length, dielectric constant, impedance, attenuation, velocity factor and connector discontinuity are each included in the matrix solution.
>
> The analysis of the present model-based solution uses, for example, 1000 or more frequency points, in order to include the narrow VSWR spikes over the band of interest. Of course, a different number of frequency points may be employed. A Pentium II-based workstation running Microsoft Windows NT 4.0, having a clock rate of at least 400 MHz,

is preferred, as each component is adjusted approximately 10 times. Using this computing hardware configuration, spending eight hours to optimize an eighty segment transmission line system is not unusual.

The input to the computer program is changed to increase and decrease each transmission line segment length, testing its sensitivity to reduce VSWR peaks. Every test, i.e., set of segment lengths, requires a new analysis, i.e., calculation of the entire matrix. The length of each segment is incrementally altered until peaks can not be reduced without levels rising in another area. At the beginning of the process, a 1% change increment in line length is used. Subsequently, the change increments are reduced to 0.1%, and then to 0.01%. Clearly, the choice of decade differences in optimization phases is a matter of engineering choice, and other increments and optimization phase change ratios may be employed as desired. Each transmission line segment is revisited many times during each phase of the analysis. The final, optimized lengths are quite different from those putative values present early in the analysis. The limit to reduction of the peaks is similar reaching to the RMS value of the trace.

Thus, it is clear that the process of optimization (successive approximation based with successively smaller steps) is clearly described: The length parameters of the segmented transmission line are provided with a default starting condition, and sequentially tested and altered in order to obtain an optimum set which meets or best meets the stated performance criteria.

In paragraph 6 of the Office Action, the Examiner makes a rejection that, because the Examiner believes that the specification does not describe a transmission line as completely as the Examiner would like, that somehow the inventor was not in possession of the invention. Applicant reiterates his request to the Examiner of a definition of his proposed level of skill in the art. Is the ordinarily skilled artisan a technician? An electrical engineer? A Ph.D (as is the Examiner)? An expert in the field of microwave device analysis with 10 years' industry experience? A high school dropout?

It is the Examiner's burden, in formulating such a rejection, to describe the level of skill in the art.

The Examiner, indeed recites the Graham v. Deere test for obviousness, which requires an assessment of the relevant level of skill in the art, then conveniently omits this portion of the analysis. Thus, the Examiner imposes a rejection under 35 U.S.C. § 103, which presumably employs the same level of skill in the art test. In this case, the Examiner states "transfer functions are inherent in the analysis and characterization of transmission lines. However, Fleming-Dahl does not explicitly teach transfer functions." "Huss discloses 'A mathematical

and lumped-element model for multiple cascaded lossy transmission lines with arbitrary impedances and discontinuities.' Huss further discloses a mathematical and lumped-element model for multiple cascaded lossy transmission lines with arbitrary impedances and discontinuities is presented. The mathematical model is developed using the ABCD matrix representation of a two-port network. The lumped element model uses pole-zero approximations to cable transfer functions."

How is it that the person of ordinary skill who cannot figure out a model or transfer function of a coaxial line, could find and employ this reference from the technical literature, which tells him how to model a transmission line using classical transfer functions?

It is respectfully submitted that the Examiner has not set forth a prima facie case of failure to comply with 35 U.S.C. § 112, first paragraph, and even assuming arguendo that he has, that these rejections are overcome by a presentation of evidence.

With respect to Issue 9 of the Office Action, please note that the "means for" elements correspond structurally to a general purpose computer, programmed to implement the algorithm or optimization strategy described in the specification. There is no particular resort to extrinsic description required. The functions performed are described in the specification, and, in part, recited above.

The Examiner continues to request a copy of the computer code. In fact, there is no legitimate reason for making this request at this time. Obviously, if this had been included with the original application, it could be used by applicant to define the algorithm in more detail. On the other hand, Applicant believes that the application is completely enabled and presents the best mode known to the inventor, without requiring the submission of the original code, which is not publicly available. However, results of the use of this code are reported in the application. While the Examiner makes the request "so as to determine what constitutes Applicant's invention at the time of filing", this invention involves the strategy underlying the code, which is fully disclosed. The actual code is simply unnecessary and its disclosure prejudicial.

Claims 8-9, 17-20 and 22-25 are rejected under 35 U.S.C. 112, second paragraph, as allegedly being indefinite. The Examiner regards the phrase transfer function as indefinite because a transfer function involves two entities. In fact, the transmission line segment transmits a signal from an input to an output. Each segment has an entrance and an exit, and an intrinsic "transfer function" relating to the relationship therebetween. The Examiner notes that there are

different expressions and applications for the transfer function. In fact, for a transmission line, acting in its capacity as a transmission line, there is but one true transfer function, as well as various standard and accepted approximations for the transfer function, some of which may be more accurate than others. These may be expressed in a variety of forms, but the essence is the same.

The phrase "may be defined" is replaced with "is defined".

Applicant has previously argued that this amendment was illogical. Applicant has reviewed the Examiner's analysis and found it persuasive. While applicant does not agree that the original claim language fatally indefinite, the amendment proposed by the Examiner is made. Upon further review, no paradox is present, subject to the following statement: As a result of <u>employing</u> the stored algorithm, using a set of stored characteristic values, an adjusted set of characteristic values representing an optimum <u>is</u> defined.

The term "substantially" has been cancelled. This amended claim language is intended to denote that the strategy for selection of the segment length values is not based on an algorithm which presumes that the values are disposed incrementally or monotonically.

It is respectfully submitted that claims 1, 8-9, 17-20 and 22-25 are now clearly definite, and comply with the requirements of 35 U.S.C. § 112, second paragraph.

Claims 1-25 are rejected under 35 U.S.C. § 112, second paragraph, as being incomplete for omitting essential steps or elements. The Examiner states that the applicant has not claimed details of the method or apparatus which are necessary for carrying out the optimization.

Applicant respectfully disagrees. The optimization according to the present invention is broadly claimed because applicants are entitled to such claim scope, without regard to the implementation details of the optimization algorithm. The prior art techniques make presumptions as to what will be acceptable to meet the performance criteria. The present invention, on the other hand, searches (including an analysis of the suboptimal conditions) until an optimum condition is found (one that meets the performance criteria). This supports a claim scope using the word "optimizing", and no further eloquence need be provided.

ART REJECTIONS (35 U.S.C. §§ 102-103)

Claims 10-11 and 13-21 are rejected under 35 U.S.C. § 102(b) as being anticipated by Fleming-Dahl US 5,218,326. The '326 patent relates to a mathematical method for defining a set

of coaxial cable lengths, <u>in no particular order order</u>, which operates in the abstract on pure numbers representing lengths to achieve a desired set of relative lengths. At no time during the optimization of the cable lengths is the <u>performance</u> of the segmented transmission line <u>modeled</u>, nor is the <u>model evaluated</u>. The Examiner has therefore failed to set forth a prima facie case of anticipation. Therefore, the reference fails to anticipate the present claims. Because the order is not defined, a critical aspect of an optimum system cannot be established, that of <u>order sensitivity</u>. Order matters, because each discontinuity at a segment boundary results in a power reflection; the successive power reflections interact, and can create both constructive and destructive interference. Thus, by simply optimizing the lengths of the segments, and not their order, undesired interactions may occur, and advantageous interactions cannot be promoted.

The results of the use of the method according to the present invention thus differ from those of the '326 patent, and there is no reason to conclude that any arbitrary optimization procedure would produce a similar result to that of the '326 patent, indicating that this procedure is not "optimum". Please note that the background of the invention section of the '326 patent states: "Impedance matching techniques are especially impractical in systems, ..." In fact, the '326 patent rejects electrical analysis methods, in favor of a mathematical formula which is not based on an optimization.

Claims 1-9, 12 and 22-25 are rejected under 35 U.S.C. § 103(a) as being obvious over the '326 patent in view of Huss. The Examiner admits that Fleming Dahl fail to disclose a transfer function (i.e., a performance assessment parameter), for which Huss is cited. As stated above, Applicant agrees that Huss teaches a transfer function of a transmission line. In contrast to the Examiner's statement that it would have been obvious to combine Fleming Dahl and Huss, it is not seen that there is any teaching or motivation in the references to combine.

The '326 patent discloses that a mathematical sequence may be used <u>instead</u> of a performance analysis, to yield a useful result. Apparently, this is the case: the results according to the '326 patent apparently can meet the stated performance criteria. On the other hand, there is no optimization, and the result is suboptimal; that is, if the performance criteria had been further constricted, at some point the method of the '326 patent would fail, while the method according to the present invention would succeed.

As noted in paragraph 27 of the Office Action, "transfer functions are inherent in the analysis and characterization of transmission lines. However, Fleming-Dahl does not explicitly teach transfer functions." This is because Fleming-Dahl <u>do not analyze or characterize the transmission line</u>.

While Huff apparently performs a transmission line performance analysis, this reference is silent on multisegment effects, and provides no practical means for analyzing a multisegment system, nor a strategy for optimizing such a system.

How is the transfer function of Huss applied to the order of component lengths defined by Fleming Dahl? If one were to model the transfer function of a single segment of the transmission line or multiple segments of the line, how is this model used to influence the selection of the set of characteristic values? The Examiner, for some reason, focuses on "component manufacturing tolerances" by bolding this text. Are these tolerances relevant to the application of a transfer function? To the order of segments?

The scheme according to Fleming-Dahl fails to determine an effect of segment sequence, as required by claims 1 and 22, and indeed provides no motivation therefore. In contrast, according to the present invention, the sequence of lengths is a factor in the optimization.

The prior art fails to teach or suggest the application of a complex aggregation of transfer functions of transmission line segments to formulate a model of the complete system, and then employ an optimization algorithm to adjust a "set of characteristic values" to achieve a desired system response.

While the Examiner might argue that "optimization" of a physical system is always obvious, this is simply not the case, especially where computational complexity is an issue. The reason is that, for runs with only a few line segments, the issues were readily solved using trial and error, intuition, or other known techniques, and for complex systems having many line segments, the modeling problem was considered intractable, requiring substantial simplification which gave poor results. Applicant, however, found that this approach could be made effective, and provided new and useful results.

With respect to paragraph 46 of the Office Action, applicant respectfully disagrees. That the claim encompasses presently unknown embodiments is not fatal to the claim; in fact, the

Supreme Court in its recent decision in the Festo case clearly permits an applicant to encompass future-developed embodiments. There is simply no requirement that these be encompassed, if at all, under the Doctrine of Equivalents, which is principally designed to assist, where the problem could not be foreseen. The issue is whether the claim need be narrowed to exclude known or presently contemplated embodiments. The Examiner has presented no art which would require applicant to distinguish a type of optimization, and applicant declines to narrow the claims without an express reason to do so. There is simply no requirement in law that claims be limited to preferred embodiments.

It is therefore respectfully submitted that the present application is allowable.

Respectfully submitted,

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